IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	:	Chieh Ou-Yang	Confirmation No. 3335
Serial No.	:	10/725,795	
Filed	:	December 2, 2003	
Art Unit	:	1792	
Examiner	:	Kirsten Jolley	
Title	:	METHOD AND APPARATUS FOR CONTROL OF LAYER THICKNESS	
Docket No.	:	35194US1	

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF (37 CFR §41.37)

This brief is filed pursuant to Rule 41.37 following the Notice of Appeal and Pre-Appeal Brief Request for Review that were both filed on September 10, 2008. The Notice of Panel Decision from Pre-Appeal Review mailed October 8, 2008 indicated the application was to proceed to the Board. The un-extended deadline to file this Appeal Brief is November 10, 2008, and this Brief is being timely filed by that date.

Please charge the $540 Appeal-Brief fee (large entity) under 37 CFR § 41.20(b), as well as any additional fees required by this Brief and throughout the remainder of this proceeding, to our Deposit Account No. 16-0820, Order No. VOSS-35194US1.

This brief contains the following sections in the order set forth below (37 CFR §41.37(c)):

I. Real Party in Interest

The real party in interest in this appeal is Singulus Technologies AG. Documents evidencing the complete chain of title from the inventor to Singulus Technologies AG have been recorded in the USPTO as follows:

From	To	Reel/Frame	Date Recorded
Ou-Yang, Chieh	Unaxis Balzers Ltd.	015137/0216	3/29/2004
Unaxis Balzers Ltd.	OC Oerlikon Balzers AG	020632/0580	3/11/2008
OC Oerlikon Balzers AG	Oerlikon Trading AG, Truebbach	020634/0896 020686/0450[1]	3/12/2008 3/20/2008
Oerlikon Trading AG, Truebbach	Singulus Technologies AG	021679/0878	10/16/2008

[1] This document was recorded to correct the nature of conveyance from "change of name" to "assignment" for the document recorded at 020634/0896.

II. Related Appeals and Interferences

Appellant is aware of no appeals, interferences or judicial proceedings that may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1, 5-10, 12 and 13 are pending in this application.

Claim 5 stands rejected under 35 USC § 112, second paragraph, because it depends from a canceled claim.[1]

Claims 1 and 6-8 stand rejected under 35 USC § 102(b)/103(a) as being either anticipated by or obvious over Shirley (U.S. Pat. No. 6,322,626).

Claims 1, 5-10 and 12-13 stand rejected under 35 USC § 103(a) as being obvious over Kim et al. (U.S. Pat No. 5,932,009) in view of Thakur (U.S. Pat. No. 6,174,651).

Claim 9 stands rejected under 35 USC § 103(a) as being obvious over Shirley in

[1] Appliant has filed an Amendment Under Rule 1.116 to correct the antecedent basis of claim 5; *see* Section IV (Status of Amendments) below.

view of Mandal et al. (U.S. Pat. No. 6,238,735) or Kim et al.

Claims 10, 12 and 13 stand rejected under 35 USC § 103(a) as being obvious over Shirley.

No claims are currently allowed.

All claims not specifically referred-to above (claims 2-4, 11 and 14) are canceled.

The rejections of claims 1, 5-10, 12 and 13 identified above are being appealed herein.

IV. Status of Amendments

An Amendment Under Rule 1.116 was filed November 10, 2008 to correct the antecedent basis of claim 5, so that it will depend from claim 1 instead of from now-canceled claim 4. This amendment has not yet been entered. No other claim amendments were filed after the final rejection.

V. Summary of Claimed Subject Matter

Claim 1 is the only independent claim under appeal. It is directed to a method for distributing a viscous liquid over a surface of a substrate, for example in conjunction with the manufacture of optical discs such as CDs and DVDs. The claimed method is summarized concisely below, wherein exemplary corresponding support in the specification and drawings is indicated parenthetically.

According to the method, a substrate is placed essentially horizontal on a support (*see* Figs. 1 and 2 wherein substrate **1** is placed essentially horizontal on support **2**; p. 6, ln. 9; p. 6, ln. 27 to p. 7, ln. 1). A viscous liquid is applied onto a surface of the substrate (p. 1, lns. 17-18; p. 2, ln. 2; p. 3, ln. 25 to p. 4, ln. 1; p. 4, lns. 13-14; p. 4, lns. 18-20; p. 5, lns. 18-20), and the substrate is rotated to distribute the deposited liquid radially outwards (*see* arrow in Figs. 1 and 2 indicating a direction of spinning the substrate; p. 2, lns. 5-13; p. 2, lns. 24-27; p. 4, ln. 6; p. 4, lns. 19-20). The liquid applied to the substrate is thermally conditioned to influence its viscosity locally by creating a locally selective temperature gradient (p. 2, ln. 27 to p. 3, ln. 2; p. 4, lns. 1-14; p. 7, lns.

17-20). Thermal conditioning of the liquid on the substrate surface is effected by a thermal source of heat or cold placed above the surface of the substrate, where the liquid has been applied (p. 4, lns. 5-8; p. 7, lns. 3-10 describing how arm **11** in Fig. 2 in a preferred embodiment carries both thermal sources and dispensing means for the viscous liquid; *see* also Fig. 2, where radiation source **10** is disposed above the substrate surface where liquid is applied, opposite the support **2** where the substrate **1** is carried). That thermal source, located above the liquid-coating substrate surface, includes a stream of heated or cooled gas (p. 5, ln. 7), or a source of electromagnetic radiation (p. 5, lns. 8-9).

Additional aspects of the claimed method are further described, e.g., at pp. 4-8 of the specification.

VI. Grounds of Rejection to Be Reviewed on Appeal

A. Whether claims 1 and 6-8 are unpatentable under 35 USC § 102(b)/103(a) over Shirley;

B. Whether claims 1, 5-10 and 12-13 are unpatentable under 35 USC § 103(a) over Kim et al. in view of Thakur;

C. Whether claim 9 is unpatentable under 35 USC § 103(a) over Shirley in view of Mandal et al.; and

D. Whether claims 10, 12 and 13 are unpatentable under 35 USC § 103(a) over Shirley.

VII. Argument

A. <u>Legal Standards</u>

1. Anticipation under 35 USC § 102(b)

A patent claim is anticipated under 35 USC § 102(b) only if each and every limitation in the claim is found in a single prior art reference. *Advanced Display Systems, Inc., et al. v. Kent State University, et al.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000). However, mere disclosure is not enough. In addition, “the four corners of [the]

single, prior art document [must] describe every element of the claimed invention…such that a person of ordinary skill in the art could practice the invention without undue experimentation." *Id.*, *citing Atlas Powder Co. v. Ireco Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999) and *In re Paulsen*, 30 F.3d 1475, 1479 (Fed. Cir. 1994). "Because the hallmark of anticipation is prior invention, the prior art reference – in order to anticipate under 35 USC § 102 – must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.'" *Net Monein, Inc. v. Verisign, Inc., et al.*, 2008 U.S. App. LEXIS 21827, 21-22 (Fed. Cir. 2008)[2], *quoting Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983).

Accordingly, anticipation cannot be established by plucking and combining numerous features from different portions of a reference, or from different machines or components described in the reference, unless that reference specifically indicates those features may or should be so combined; i.e. <u>unless the references teaches those features "arranged as in the claim</u>." *Connell*, 722 F.2d at 1548. *See* also *Finisair Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1334-1335 (Fed. Cir. 2008) ("To anticipate a claim, a single prior art reference must expressly or inherently disclose each claim limitation. But disclosure of each element is not quite enough--this court has long held that anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention <u>*arranged as in the claim*</u>.") (internal citations omitted, emphasis added).

2. Obviousness under 35 USC § 103(a)

Title 35 of the U.S. Code, § 103(a) provides that although an invention is not identically disclosed as set forth in Section 102, a patent for that invention still may not be obtained if the "differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the

[2] *Net Moneyin* was recently decided on October 20, 2008, and has not yet been published in either the Federal or USPQ reporters. Accordingly, a copy of this case is enclosed with this brief. 37 CFR § 41.12(b).

time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

The Examiner has the burden to establish a *prima facie* case of obviousness. The requirements to establish a *prima facie* case of obviousness are set forth in Section 2143 of the latest edition of the *Manual of Patent Examining Procedures* (MPEP) as follows (emphasis added):

> To establish a prima facie case of obviousness, three basic criteria must be met. First, *there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings*. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.
> The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In *KSR Int'l v. Teleflex Inc. et al.*, 127 S. Ct. 1727, 82 USPQ2d 1385 (2007), the Supreme Court revisited the requirement of motivation to combine elements in the prior art. There, the Court rejected a rigid application of the Federal Circuit's so-called teaching-suggestion-motivation ("TSM") test to require that such motivation come from the references themselves. The Court further rejected the notion that the motivation to combine prior-art elements need be the same as or similar to that underlying the patentee's invention. "Under the correct analysis, *any need or problem* known in the field of endeavor at the time of the invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." 82 USPQ2d at 1389-1390 (emphasis added). As can be seen, *KSR* did not eliminate the requirement of an objective reason to combine teachings in the prior art (the "suggestion or motivation" described in MPEP § 2143, quoted above). Instead, the Court made clear that the objective reason may be supplied from a problem other than that which was the focus of the inventor, including from other objective sources (e.g. general knowledge) available and known to persons of ordinary skill in the art.

> [The diversity of inventive pursuits and of modern technology counsels against confining the obviousness analysis] *by overemphasizing the*

> *importance of published articles and the explicit content of issued patents. In many fields there may be little discussion of obvious techniques or combinations, and market demand, rather than scientific literature, may often drive design trends*.
>
> * * *
>
> Under the correct analysis, *any need or problem known in the field* and addressed by the patent can provide a reason for combining the elements in the manner claimed.
>
> * * *
>
> When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.

Id. at 1396-1397 (emphasis added). Thus, any objective reason to combine elements in the prior art, and not just those recited in "published articles [such as prior art patents] or the explicit content of issued patents," can provide a basis to suggest a claimed combination is obvious. As the Supreme Court pointed out in *KSR*, that suggestion may even be grounded in the common-sense principal that known elements can be combined to produce nothing but the sum of their predictable effects. But, some objective reason to combine elements still must exist to sustain an obviousness rejection under 35 USC § 103(a). Without an objective reason to combine prior-art elements, whatever its source, the combination of those elements is patentable and not obvious.

The combination of prior-art elements is not obvious when the art, or the references reflecting the art, counsel(s) against their combination. *KSR* acknowledged that if a reference teaches away from the proposed combination, such 'teaching away' continues to weigh strongly against a finding of obviousness. "[W]hen the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." 82 USPQ2d at 1395, *citing United States v. Adams*, 383 U.S. 39, 51-52 (1966). *See* also *In re Icon Health and Fitness, Inc.*, 496 F.3d 1374, 1381 (Fed. Cir. 2007) ("A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or *would be led in a direction divergent from the path that was taken by the applicant*,") (emphasis added).

When the prior art has embraced one solution to a recognized problem, and rejected another because the other solution was considered to be unworkable, then he who embraces and perfects the other solution is entitled to a patent on his invention for his insight. This result flows from the requirement that there must be a reasonable expectation of success in combining prior-art elements to achieve the sum of their predictable results. If the art has instead concluded that the proposed combination <u>would not work</u>, and therefore teaches persons of ordinary skill not to use it, then the combination cannot be considered obvious. Such a combination is patentable, if it works, because it has achieved more than "the anticipated success" of combining the separate elements. 82 USPQ2d at 1397. It has instead achieved an unpredictable result contrary to the teachings and wisdom of the art.

B. <u>Summary of Applied References</u>

1. U.S. Patent No. 6,322,626 to Shirley (hereinafter "Shirley")

Shirley discloses a device for controlling the temperature distribution of a substrate onto which a photoresist material is to be deposited. Shirley's device includes separate chill plate and coater bowl assemblies 20 and 30. Both these assemblies 20 and 30 are seen in Fig. 1, and a substrate can be transferred between them via a transfer device 40 as seen in the figure. The chill plate assembly 20 has a plate temperature controller 50a and the coater bowl assembly has a bowl temperature controller 50b. The plate temperature controller 50a has a fluid supply 51a to deliver a temperature-control fluid to a series of manifolds 54a positioned proximate a substrate 70, via conduits 53a. The temperature-control fluid can be directed to the backside of the substrate 70 via the plate temperature controller 50a to influence the substrate's temperature, e.g. in advance of being transferred to the coater bowl assembly 30 where a photoresist will be applied. In one embodiment, the plate temperature controller 50a (including orifices 55a) can be positioned to direct fluid streams or jets to "impinge on a back side 71 of the substrate." Col. 3, lines 24-40. "In still further embodiments, the orifices 55a can be positioned proximate to the front side 72 (rather than the back side 71) of the substrate to transfer heat directly to or from the front side 72." Col. 4, lines

20-24.

<u>Separately</u>, the bowl temperature controller 50b of the coater bowl assembly 30 has its own orifices 55b, which are disposed to direct temperature-control fluid to the back side 71 of the substrate 70 when it is positioned in the coater bowl assembly (*see* Fig. 1). In the illustrated embodiment, the bowl temperature controller 50b has a single fluid supply 51b "coupled to a <u>*single*</u> heat exchanger 52b which is in turn coupled with a conduit 53b to a <u>*single*</u> manifold 54b." Col. 4, lines 61-64 (emphasis added). "In another embodiment, the bowl temperature controller 50b can include <u>*a plurality*</u> of heat exchangers 52b and manifolds 54b, arranged in a manner generally similar to that" of the plate temperature controller 50a. Col. 5, lines 9-14 (emphasis added). Nowhere does Shirley disclose or suggest positioning the bowl temperature controller 50b, or its manifold(s) 54b or orifice(s) 55b above the substrate to direct temperature-control fluid to the upper surface 71 of the substrate 70 where photoresist or any other material is being applied to that surface.

2. U.S. Patent No. 5,932,009 to Kim et al. (hereinafter "Kim")

Kim is similar to Shirley in that it discloses a device to regulate the temperature of a substrate (wafer 10) to "reduce variations of photoresist flow and therefore reduce variations in the resulting photoresist layer thickness" applied to the wafer 10. Col. 4, lines 9-18. Also like Shirley, temperature control is supplied from beneath the wafer when photoresist material is being applied, via temperature controller assembly 50. Specifically, infrared energy is guided from a generator 51 to heat specific portions of the rotation chuck 113 on which the substrate 10 is resting and spinning, via optical cable 52. Col. 4, lines 59-63. "The heat purposefully introduced at the heating points on the rotating chuck 113 can be applied directly to the backside of the wafer 10. However, indirect heating through the rotation chuck 113 is preferable to prevent the wafer 10 from being thermally damaged at the point of heat introduction." Col. 4, lines 53-57. Like Shirley, Kim nowhere discloses or suggests applying heat directly to the upper surface of the wafer 10 during the application of a liquid photoresist or other material to that surface.

3. U.S. Patent No. 6,174,651 to Thakur (hereinafter "Thakur")

Thakur is directed to a method for depositing atomized droplets onto a substrate. The droplets are heated with a light/heat source, whereupon solvent in the droplets is vaporized and the solute from the droplets is thereby precipitated as a solid. "Before and/or after contacting the wafer, the liquid droplets are exposed to light energy, which causes the photoresist material to form a solid coating on the substrate. In some configurations, the substrate is also heated to aid in the deposition process." Col. 3, lines 43-51. "The light energy absorbed by the liquid droplets can originate from lamps." Col 3, lines 56-57. As will be appreciated from Figs. 1a and 3, the uniformity of coating deposition is controlled by the dispersal pattern of atomized droplets resulting from the design of the nozzle 14. Specifically, the nozzle 14 illustrated in Fig. 3 "includes a plurality of openings 15 which are designed to atomize the solution containing the photoresist material…in order to uniformly disperse the liquid droplets over the surface of substrate 18." Col. 5, lines 55-61. The uniformity of the deposited coating does not depend on any liquid spreading over the substrate surface. In Thakur, light energy is used merely to vaporize liquid in the atomized droplets to precipitate the solute as a solid coating. While Thakur mentions the substrate may be heated, this is only to promote vaporization of the solvent "to aid in the deposition process." There is no mention of any precise temperature control at the substrate surface, or of the precise application of energy to create a "locally selective temperature gradient" in the substrate or in a deposited liquid to influence its viscosity, as presently claimed. *See* col. 7, lines 49-55 of Thakur: "Lamps 24, 26 and 28 need to deliver a sufficient amount of energy to the liquid droplets for causing the liquid droplets to vaporize, react or decompose and transform the parent material into a solid." There is no mention of temperature-gradient control. Indeed, Thakur expressly provides that "[t]hrough the use of lamps, a rapid isothermal processing system is produced." Col. 8, lines 4-5. Thus, no temperature <u>gradient</u> control of the substrate or the coating thereon is contemplated, or possible in Thakur. Finally, Thakur expressly distinguishes its atomized-droplet deposition process from conventional spin-coating processes where a liquid is deposited onto the substrate and then spread in the liquid state by application of centrifugal forces, as in Shirley and

Kim. Col. 2, line 57 to col. 3, line 11.

C. Claim 1 is not anticipated by or obvious over Shirley

Claim 1 stands rejected under 35 USC § 102(b)/103(a) as being anticipated by or obvious over Shirley. Claim 1 requires, *inter alia*, "conditioning the liquid on the substrate thermally, to influence its viscosity locally by creating a locally selective temperature gradient; said thermal conditioning being effected by a thermal source of heat or cold placed above the surface of the substrate." Shirley neither discloses nor renders obvious this construction, wherein the thermal conditioning is achieved from a thermal source above the substrate surface; i.e. the surface where the liquid has been applied.

Rejection under 35 USC § 102(b) over Shirley

Shirley's device contains a chill plate assembly 20 having a plate temperature controller 50a, and a coater bowl assembly 30 having a bowl temperature controller 50b (*see* Fig. 1). These are two separate devices. The chill plate assembly 20 provides pre-coating conditioning to the substrate 70 before it is transferred to the coater bowl assembly 30. Importantly, no coating is applied to the substrate in the chill plate assembly 20. So there is no impediment to providing temperature control from above the substrate 70 versus below it. Conversely, once the substrate 70 is transferred to the coater bowl assembly 30, temperature control from above is avoided, so as not to interfere with the deposition of liquid to the upper surface (front side 72) of the substrate 70.

The chill plate assembly 20 and its temperature controller 50a are described first in Shirley, beginning at col. 3, line 25. There, it is explained that the plate temperature controller 50a (in the chill plate assembly 20) has a fluid supply 51a coupled via conduit**s** 53a (plural) to manifold**s** 54a (again, plural).

Subsequently, the coater bowl assembly 30 and its temperature controller 50b are described, beginning at col. 4, line 43 and continuing into column 5. There, Shirley states:

> In one embodiment, the temperature controller 50b includes a fluid supply 51b coupled to a *single heat exchanger 52b*

> which is in turn coupled with a conduit 53b to a *single manifold 54b*. * * * In another embodiment, the bowl temperature controller 50b can include a *plurality of heat exchangers 52b and manifolds 54b*, arranged in a manner generally similar to that discussed above with reference to the plate temperature controller 50a.

Col. 4, line 58 to col. 5, line 14 (emphasis added).

The last quoted sentence is the focus of the Section 102 rejection. The Examiner has argued that this sentence means the bowl temperature controller 50b (or at least its nozzles 55b) can be located *above* the substrate 70, similar to nozzles 55a of the plate temperature controller 50a as described at col. 4, lines 20-22. This interpretation is contrary to what is expressly described. The plain meaning of the quoted language is simply that "a plurality" of heat exchangers and manifolds 52b,54b is an alternative to the "single" heat exchanger and manifold described previously. This is clear from the fact that Shirley expressly describes the "single" heat exchanger/manifold structure, and then discloses a "plurality" of these as an alternative. The statement, "arranged in a manner generally similar to…the plate temperature controller 50a," is a reference to the fact that multiple heat exchangers and manifolds 52a and 54a have already been described for the plate temperature controller 50a, as illustrated in Fig. 1, and that a plurality of the analogous heat exchangers and manifolds 52b and 54b may also be used in the bowl temperature control 50b. In other words, the sentence merely states that like the plate temperature controller 50a, the bowl temperature controller 50b also can have multiple heat exchangers and manifolds instead of the "single" manifold and heat exchanger illustrated, and that their arrangement (i.e. multiple heat exchangers and the corresponding manifolds stemming from a fluid source) can be similar when multiple of these are used in the bowl temperature controller 50b. There is no implication that the location of the bowl temperature controller 50b can or should be changed, to place it above the substrate.

In fact, the opposite inference is appropriate from Shirley. That reference clearly disclosed the orifices 55a of the plate temperature controller 50a could be "positioned proximate to the front side 72 (rather than the back side 71) of the substrate 70…." Col. 4, lines 20-22. In contrast, there is no such teaching for the bowl temperature controller

50b or any of its components. Had Shirley intended such an alternative, the reference could have easily described it. Doing so would have required the insertion of only two words in the last sentence in the passage quoted above: "…arranged <u>and located</u> in a manner generally similar to that discussed above with reference to the plate temperature controller 50a." Yet Shirley contains no such teaching.

The plain meaning of the quoted language from Shirley, relied upon by the Examiner, simply does not disclose positioning the bowl temperature controller 50b <u>above</u> the substrate as the Examiner has argued. Furthermore, the <u>opposite</u> inference is appropriate because Shirley clearly explains that the plate temperature controller 50a can be located above the substrate in the chill plate assembly 20, but says nothing of the sort for the bowl temperature controller 50b in the coater bowl assembly 30. When a reference does not teach a proposed structure but in fact implies that structure <u>is not</u> present, the reference cannot be said to anticipate that structure in a patent claim. For at least these reasons, the Examiner's interpretation of Shirley to reject claim 1 under 35 USC § 102(b) is incorrect.

<u>Rejection under 35 USC § 103(a) over Shirley</u>

The Examiner has argued that:

> it would have been obvious to…have incorporated the optional embodiments of the chill plate assembly [50a] (such as positioning the orifices [55a] above the substrate rather than below the substrate) in Shirley's coater assembly [50b]…with the expectation of similar and successful results because both Shirley's chill plate and coater assemblies have similar structures, effects, and purposes – to similarly provide heating or cooling to selected areas of a substrate, and because Shirley specifically teaches the incorporation of the features of the chill plate assembly into the coater bowl assembly.

Final Office action, p. 6.

First, as already explained, Shirley <u>does not</u> specifically teach incorporating the 'location of the orifices' feature of the chill plate assembly (plate temperature controller 50a) into the coater assembly (bowl temperature controller 50b). In fact, the <u>opposite</u> inference is appropriate as noted above, because Shirley expressly discloses such a

possibility for the controller 50a but <u>not</u> for the controller 50b. As argued during prosecution as well as above, the fair and appropriate meaning of the language relied upon by the Examiner, taken in the appropriate context where it is found, is that instead of a <u>single</u> heat exchanger and a <u>single</u> manifold for the bowl temperature controller 50b, "a <u>plurality</u> of heat exchangers" and a "<u>plurality</u> of manifolds" arranged similarly as in the plate temperature controller 50a can be used. Nothing in Shirley indicates that the <u>location</u> of the manifold(s) and orifice(s) can be moved from below the substrate in the coater bowl assembly 30 to above the substrate.

To further evidence this fact, the <u>location</u> of the bowl temperature controller 50b in Shirley cannot be shifted to above the substrate 70 in the coater bowl assembly 30 because at least the central nozzle/manifold 53a from the chill plate assembly 20 would interfere with or displace the liquid nozzle 35, which is centrally located above the substrate in the coater bowl assembly 30 (see Fig. 1). The Examiner has acknowledged this point, but then argued that "an engineer having ordinary skill in the art would recognize that some adjustments to the design would be required when incorporating the alternative suggested embodiments, and an engineer would be capable of designing a bowl controller that incorporates the alternative suggested embodiments." Office action dated November 1, 2007, p. 4. Respectfully, however, the liquid nozzle 35 in Shirley cannot be readily moved (or "adjusted") as the Examiner suggests, because this would result in non-uniform coverage of the liquid on the spinning substrate. The liquid is spread through application of centrifugal forces as the substrate spins, causing the liquid to spread radially out from the center. If that liquid were applied at a location other than the geometric center of the substrate when stationary, then the centrifugal forces induced on spinning the substrate would cause that liquid to spread unevenly as opposed to uniformly out from the geometric center. In fact, the center would not be coated at all. Moreover, the controlled temperature gradients to regulate local viscosity would be ineffective for the same reason because those are <u>*radial*</u> gradients applied in the substrate, with each discrete temperature point provided either at the center or in an annular ring that is concentric with the center of the substrate.

In response, the Examiner argued during prosecution that a skilled engineer

could come up with a solution to the problem of centralized application of the liquid to the substrate surface, and she even suggested one: a “nozzle fit[] in the center of radial gas jets.” Office action dated June 11, 2008, p. 3. Without addressing the merit of this suggestion, its merit is not the point. Whether a skilled engineer could produce the suggested construction is not the appropriate inquiry. The appropriate inquiry is would she. That is, would a person of skill in the art have been motivated to modify Shirley as proposed, at the time the application was filed and without applicant’s claims in view. Without some objective reason to modify Shirley as claimed, whether a skilled engineer could find a way to make the modification possible is irrelevant. Shirley discloses a complete structure, with no hint as to why one might relocate the bowl temperature controller 50b above the substrate instead of below.

Moreover, as evidenced by the only two references cited by the Examiner that show application of a temperature-control fluid to regulate substrate temperature or coating viscosity, Shirley and Kim, it was universally accepted in the art that temperature control from above would detrimentally interfere with coating application. This is the reason that both Shirley and Kim apply temperature control from underneath the substrate; because conventionally it was believed that application of a temperature-control fluid above the substrate, on the same surface where the coating liquid is applied, would interfere with the uniform coating of that liquid across the substrate surface.

It will be appreciated that numerous uncontrollable and unpredictable factors will attenuate from-beneath temperature control, making it difficult to precisely and consistently achieve the desired temperature profile on the upper surface where the coating liquid is applied, or more importantly in the liquid layer itself. Such factors include, for example, the thermal conductivity/resistivity of the substrate, its thermal diffusivity, variations in thickness and density and other physical imperfections or variations in the substrate. In Kim, where indirect temperature control through the chuck 113 is preferred, the effect of these variables is even more pronounced because there will be unpredictable result-effecting variables both in the chuck 113 and the substrate. Yet despite these variables, in both Shirley and Kim temperature control is regulated from beneath the substrate and not above when a liquid coating is applied.

The reason for this is that both Shirley and Kim were operating under the conventional belief that direct temperature control from above the substrate, to directly heat or cool the liquid coating layer to regulate its viscosity, was impractical due to the anticipated negative effects on liquid application. No other reason makes sense. It cannot be disputed that the most efficient way to regulate local temperature (and thereby viscosity) gradients in a liquid coating is to directly heat or cool the liquid itself. The reason both Shirley and Kim avoided doing so is because both needed to avoid the anticipated negative effect it would have on the deposition of that coating. The applicant's invention, which bucked the conventionally-accepted view that from-above thermal conditioning would interfere with coating application, was therefore not merely the sum of predictable results. It produced the desirable result of precise gradient control in the liquid layer ***without*** the expected negative effect of impermissibly interfering with deposition of that layer.

Accordingly, not only:

a) has the Examiner not identified any objective reason to modify Shirley's coater bowl assembly 30 by placing the bowl temperature controller 50b above the substrate, and

b) does Shirley not disclose positioning that temperature controller 50b above the substrate to effect temperature control at the same surface where the coating liquid is applied; and

c) would the Examiner's proposed modification interfere with the appropriate operation of Shirley's coater bowl assembly 30 by requiring displacement of the liquid nozzle from the geometric center of the substrate 70;

but the proposed modification also was contrary to the conventional expectation that temperature control from above, at the surface where the coating liquid is applied and where it is spreading during spin-coating, would interefere with the application of that liquid on the substrate surface, as evidenced by the only two spin-coating references found by the Examiner to reject claim 1.

Contrary to Supreme Court and Federal Circuit precedent as outlined above, the Examiner has rejected claim 1 as obvious without identifying a reason, either from the

nature of a problem to be solved (the Examiner has identified no such problem), from the references themselves or from any other objective source, why the modification she suggested would be obvious. Moreover, the expectation in the art that temperature control from above would interfere with coating application and spreading on the substrate surface weighs strongly against any finding of obviousness. In support of this point, Shirley explains that arrangement proximate the back side 71 for the plate temperature controller 50a is preferred, “as such a method may be less likely to damage components or features on the front side 72.” Col. 4, lines 24-27. In view of this teaching when no liquid is present, i.e. in the chill plate assembly 20, it certainly is not obvious from Shirley to employ the less preferred front-side placement when a coating liquid is present, i.e. in the coater bowl assembly 30, when even more damage -- interference with coating application -- would have been expected to occur. Perhaps more telling is the fact that both above- and below-temperature control is disclosed for the chill plate assembly 20 (where no liquid is applied) but not for the coater bowl assembly 30 (where liquid is applied). That Shirley says the bowl temperature controller 50b can be modified in one way similar to the plate temperature controller 50a (the number of manifolds/orifices) but not in another (location) demonstrates that one would not have found the latter modification obvious for the reasons given above, and strongly refutes the Examiner’s argument of obviousness.

The inventors of the present application were the first to suggest direct coating-temperature control as a means to achieve precise, real-time temperature gradients, and corresponding viscosity gradients, in the coating layer to facilitate the desired spreading effect. This innovation has eliminated problems associated with temperature control from underneath the substrate, which is attenuated based on the thermal conductivity (resistivity), heat capacity and other physical properties of the substrate, its thickness and other experimental uncertainties. Again, please notice that in both the cited base references (Shirley and Kim) temperature control is achieved from underneath the substrate while the coating is being applied. For these reasons, in addition to those already described during prosecution (which the Board is respectfully requested to review), the obviousness rejection of claim 1 under Section 103(a) based on Shirley is incorrect.

D. Rejection under 35 USC § 103(a) over Kim in view of Thakur

Like Shirley, temperature control in Kim is effected from underneath the substrate. There is no teaching in Kim to achieve direct temperature control from above the substrate (wafer 14). Thakur does not remedy this deficiency. In Thakur, lamps or other sources of energy are used to vaporize liquid from atomized droplets above or on the substrate, not to achieve any selective temperature gradient in the substrate or in a coating liquid. Because of this, no particular control of individual lamps, or of the amount of light or other energy to be applied to one location on or above the substrate is regulated relative to the energy to be applied to another location. The only requirement in Thakur is to "deliver a sufficient amount of energy to the liquid droplets for causing the liquid droplets to vaporize, react, or decompose and transform the parent material into a solid." Thakur, col. 7 lines 49-52. No precise temperature-gradient control is necessary or desirable in Thakur, which expressly states, "[t]hrough the use of lamps, a rapid *isothermal* processing system is produced." Col. 8, lines 4-5 (emphasis added). Such an "isothermal" processing system is contrary to the effect desired and achieved in Kim or in the present claims, where a locally selective temperature gradient requires the non-isothermal application of heat energy to the substrate.

True, the lamps in Thakur are located above the substrate. But this is because they provide light energy to vaporize the atomized droplets; they do not regulate or produce any locally selective temperature gradient in the substrate or in the deposited coating. Nor could they, because in Thakur the lamps provide an "isothermal processing system." Isothermal processing may be ideal for vaporizing atomized droplets, but it will have only an uncontrolled incidental effect on the temperature of the substrate or of any resulting coating. In other words, the use of lamps in Thakur would flood the substrate and any coating deposited thereon with EM energy in an uncontrolled way that would not be effective to generate a "locally selective temperature gradient" as claimed.

The differences between the uses of light or other energy in Kim versus Thakur are significant, because they demonstrate that Thakur's use of light energy does not

suggest using Thakur's lamps in Kim's coating device, and vice versa. In Kim, IR energy is provided to the backside of a wafer to regulate spreading of a liquid resist material on the front side of the wafer, similar to Shirley. Conversely, in Thakur a coating layer is applied via a spray of liquid droplets deposited over the substrate surface, and the lamps 24, 26 are used simply to "deliver a sufficient amount of energy to the liquid droplets for causing the liquid droplets to vaporize, react, or decompose and transform the parent material into a solid." Thakur, col. 7 lines 49-52. In other words, the lamps 24 and 26 in Thakur are used to vaporize the atomized droplets sprayed from the nozzle 14, so the remaining solids may be deposited on the substrate surface.

These are two entirely different processes. The Examiner has argued Thakur is relied on merely to disclose supplying a thermal energy source above the substrate as opposed to below it in Kim. However, in order to modify Kim according to this teaching <u>there must be some nexus</u> between Kim and the teaching sought to be borrowed from Thakur that might suggest the combination. Here, there is none. The coating modes in the two references are entirely different; liquid spreading, versus the vaporization of atomized droplets to produce a coating from the resulting solid precipitate. Light bulbs used to vaporize the droplets via the isothermal application of energy are not comparable, and in fact produce <u>an opposite effect</u>, to precisely-targeted thermal sources to achieve a specific temperature <u>gradient</u> in the substrate or in a liquid coating on that substrate. Nor is such precision relevant in Thakur because the only goal is to vaporize droplets, not to ensure their uniform spreading. The uniformity of the coating in Thakur depends on the dispersal pattern of the droplets above the substrate; no liquid-phase spreading on the surface is employed. So no motivation can be seen underlying the proposed combination. Because the processes in each of Kim and Thakur, and the uses and functions of the thermal sources in each, are fundamentally different, there simply is no <u>reason</u> to borrow the 'above the substrate' feature from Thakur to suggest placing Kim's optical cables 52 or some other thermal source above the wafer in Kim.

The Examiner has characterized the two references as similar in that both "disclose the use of electromagnetic radiation to heat a semiconductor substrate," and

argued that it is therefore obvious to modify Kim to include "the means for providing electromagnetic radiation to a semiconductor substrate [i.e. above the substrate] taught by Thakur." Office action dated June 11, 2008, p. 4. Respectfully, this is an oversimplification. The broad focus of each is to achieve a uniform coating, not to heat the substrate. In Kim, heating the substrate from underneath is the means employed to achieve the desired end from a liquid-phase coating that is applied to the upper surface and spread radially through spin-coating. Conversely, in Thakur deposition of atomized droplets over the surface is the means employed, where the droplet-dispersal pattern (not spinning) controls coating uniformity. Heat is used in Thakur not to regulate the substrate temperature, but to vaporize the deposited droplets to form a solid coating. In Thakur there is no bulk liquid-phase coating, and no liquid-phase spreading; so there is no need to induce any selective temperature/viscosity gradients to regulate spreading. Thus, the application of heat via lamps in Thakur is for a totally different purpose, incongruent with that in Kim where the aim is to induce a temperature gradient to facilitate liquid-phase spreading.

In both Thakur and Kim, therefore, heating by itself is just a means to an end; more precisely it is a means to two different ends (uniform spreading in Kim, vaporization of droplets in Thankur). Thus, 'heating' by itself is no proper motivation to suggest combining the two references.

Finally, the proposed combination is also non-obvious for several of the same reasons identified above regarding non-obviousness over Shirley, namely:

> **a)** the Examiner has not identified any objective reason to modify Kim's apparatus by placing the Thakur's lamps above Kim's substrate (Thakur's lamps make no sense in Kim's apparatus, where spin-coating and not CVD via atomized droplets is used), and
>
> **b)** the proposed modification is contrary to the conventional expectation that temperature control from above, at the surface where the coating liquid is applied and where it spreads during spin-coating, would interfere with the application and spreading of that liquid on the substrate surface, as evidenced by the only two spin-coating references found by the Examiner to reject claim 1.

In summary, there is no motivation to use Thakur's lamps above the substrate in place of Kim's IR radiation from underneath to achieve uniform spreading of a liquid coating as in Kim. Thakur's lamps have no effect on the uniformity of the deposited coating in that reference. The means to supply and disperse the droplets would control uniformity. All Thakur's lamps do is vaporize the liquid droplets to leave the solid coating material behind. There is no reasonable suggestion to combine these references. Their respective thermal sources are used for entirely different, incongruent purposes, and they would not be combined by a person of skill in the art. For these and the other reasons made of record during prosecution (which the Board is requested to review), it is respectfully submitted the rejection based on Kim/Thakur is also incorrect.

E. None of the dependent claims is anticipated or obvious over the cited references

Each of the remaining claims depends directly or indirectly from claim 1. Accordingly, because the rejections of claim 1 are improper as noted above, and because all remaining claims necessarily incorporate at least the limitations of claim 1, all remaining claims are respectfully submitted to be patentable at least for the same reasons as above.

F. Conclusion

For the foregoing reasons, the rejections of all pending claims are improper. Applicant preys the Board to REVERSE the holding of unpatentability by the Examiner, and to ORDER that the present application be passed for allowance forthwith.

If any fees are required by this Appeal Brief which were not paid upon filing, then it is respectfully requested that any and all such fees be charged to our Deposit Account No. 16-0820, Order No. VOSS-35194US1.

Respectfully submitted,
PEARNE & GORDON LLP

By: /stevenjsolomon/
Steven J. Solomon, Reg. No. 48,719

1801 East 9th Street, Suite 1200
Cleveland, Ohio 44114
(216) 579-1700
Fax: (216) 579-6073

Date: November 10, 2008

VIII. Appendix of Claims Involved in the Appeal (37 CFR §41.37(c)(viii))

1. (previously presented) A method for distributing a viscous liquid over a surface of a substrate, comprising the steps:

- placing a substrate essentially horizontal on a support,
- applying a viscous liquid onto a surface of said substrate,
- rotating the substrate to distribute the liquid radially outwards, and
- conditioning the liquid on the substrate thermally, to influence its viscosity locally by creating a locally selective temperature gradient;

said thermal conditioning being effected by a thermal source of heat or cold placed above the surface of the substrate;

said thermal source comprising a stream of heated or cooled gas, or a source of electromagnetic radiation.

Claims 2-4: (canceled)

5. (previously presented[3]) A method according to claim 1, wherein the source of radiation is a lamp with essentially visible spectra or an IR radiator.

6. (currently amended) A method according to claim 1, wherein the thermal source comprises at least two sub sources.

7. (original) A method according to claim 6, wherein the sub-sources are directed to different positions with regard to the radius on the substrate.

8. (previously presented) A method according to claim 1, wherein said substrate is supported on a rotatable support, with dispensing means for said liquid provided above the substrate surface and fastening means for at least one thermal source placed above the substrate.

---

[3] As presented in Amendment After Final Under Rule 1.116 “D,” which has not yet been entered.

9. (previously presented) A method according to claim 8, wherein the fastening means comprise a cover, extending over at least a part of the support.

10. (previously presented) A method according to claim 8, wherein the fastening means comprise an arm extending over at least a portion of the support.

11. (canceled)

12. (previously presented) A method according to claim 8, wherein the dispensing means are mechanically affixed to the fastening means.

13. (previously presented) A method according to claim 10, wherein the fastening means are movable with respect to substrate and support in order to remove the arm at least during loading and unloading of the substrate.

14. (canceled)

IX. Evidence Appendix (35 USC §41.37(c)(ix))

None.

X. Related Proceedings Appendix (35 USC §41.37(c)(x))

None.